



Sensors and Automation

Eaton Wireless Sensor Network for Advanced Energy Management Solutions

Electric motor-driven systems used in industrial processes consume an estimated 679 billion kWh – or 23% – of all electricity sold in the United States. To counter such immense energy use, advanced energy management monitoring and diagnostic systems have been implemented in large electric motors (those greater than 200 HP), with the results being dramatic energy savings, economic benefits, and reduced environmental impacts. However, industrial motor energy use could be further reduced by up to 18% if methods that are typically used on larger motors were more widely deployed.

Applying monitoring and diagnostic systems to smaller motors is a logical next step. However, communication networks in use for larger motors use conventional field wiring, which is expensive and not practical for smaller motors. In order to monitor smaller motors a cost-effective communication network that can quickly collect, inspect, and diagnose information on the motors is needed. To address this issue, Eaton Corporation is leading an effort to research, test, develop, and deploy a self-configuring wireless sensor network (WSN) that operates

within a range of open wireless protocols and integrates with advanced energy management software.



Research for this project will focus on three areas. First, smart sensors with embedded intelligence will be developed. The new sensors will be designed to measure such parameters as voltage, current, and temperature at an installation cost that is significantly less than that of current options. Then, issues critical to the success of wireless networking – such as the network's robustness, security, ability to self-configure, and cost-effectiveness – will be addressed. Finally, research will be conducted to ensure that the network's energy management, diagnostic, and control systems are able to take into account the full complexity of the plants being monitored.

Applications and Benefits

The technology developed from this project will have far-reaching benefits for plant managers and industry beyond energy savings and environmental gains. These benefits include:

- Ultra-low power design.
- Drastically reduced installation costs.
- Dramatically reduced maintenance.
- Reduction in installation and infrastructure costs by up to 84%.
- Application in other fluid and mechanical power systems, not just motors.

Project Participants

Eaton Corporation
(Lead organization)
Red Wing Technologies
Adventium Laboratories
BP
International Paper
Weyerhaeuser

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Project Plans and Progress

Project History: This project was awarded under the Sensors, Controls and Automation Crosscutting Technologies solicitation. The award was signed in the spring of 2004.

The project will be performed in three phases that will focus on baseline system development, concept feasibility, and concept validation.

Phase I will focus on the creation of a baseline WSN suitable for operation in an industrial environment. During this phase, researchers will:

- Derive and document WSN requirements.
- Investigate, assess and, document alternative solutions.
- Develop design specifications.
- Build the wireless system, integrate hardware and software, and construct a test bed system.
- Develop test plan and perform baseline tests.

Phase II will extend the baseline by addressing issues that are critical to fielding a robust wireless industrial network. During this phase, researchers will:

- Develop and evaluate concepts to enable wireless modules to be either ultra-low or zero power for use beyond the electrical system.
- Increase the robustness of self-configuration and routing algorithms.
- Address packaging issues.
- Implement security to meet industrial needs.
- Conduct tests to evaluate the performance of WSN.

Phase III will focus on conducting field tests. During this phase, researchers will:

- Develop final plans to bring the new product – the packaging and creation of which will be funded by Eaton – to market.
- Identify applications that will benefit industry.
- Implement design advances to enhance performance.
- Develop product roll-out plan for WSN manufacturing, marketing, and commercial introduction.



Sensors and Automation

The Sensors and Automation Activity (S&A), part of the Industrial Technologies Program, develops and deploys integrated measurement systems for operator-independent control of manufacturing processes with broad applicability across multiple industry sectors.

The industry sectors served by S&A are those that have established partnerships with the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy to collaborate in joint technology development for the competitiveness and vitality of the industry.

Work done under S&A will lead in providing the advanced measurement and control technology solutions to meet the needs of all industry sectors supported by the IOF strategy.

To learn more about S&A activities, visit the program web site at:

www.oit.doe.gov/sens_cont/

A Strong Energy Portfolio for a Strong America

Energy Efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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The CPS number for this project is 14225.

